

## PATENT ABSTRACTS OF JAPAN

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NISHINO TOMOHIRO**(54) METHOD FOR MANUFACTURING CERAMIC HONEYCOMB STRUCTURE, SLURRY FOR REINFORCING PARTITION WALL, AND CERAMIC HONEYCOMB STRUCTURE**

(57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a method for manufacturing a honeycomb structure in which productivity is improved, the cost reduction of a product can be remarkably improved, the honeycomb structure having desired performance is obtained without deformation or the like at the partition wall, and further a stable erosion resistance can be brought out with a uniform reinforced part.

**SOLUTION:** The method for manufacturing the honeycomb structure comprises the steps of molding a body containing a ceramic material as a main component and a water soluble organic binder to manufacture a base of the honeycomb structure in which a plurality of cells are formed by a plurality of partition walls, adhering a slurry for reinforcing the partition walls in which a partition wall reinforcing material is dispersed in a dispersing medium at the end of a cell opening end face to the plurality of the partition walls of the base, thereafter drying and baking the material. As the dispersing medium of the slurry for reinforcing the partition walls, a dispersing medium containing a water soluble liquid-like compound which is substantially non-soluble in the water soluble organic binder as a main component is used.

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**CLAIMS**


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**[Claim(s)]**

[Claim 1] Use a ceramic ingredient as a principal component, fabricate the plastic matter containing a water-soluble organic binder, produce the base material of the honeycomb structure in which two or more cells are formed by two or more septa, and at the edge in a cell opening end face to these two or more septa of this base material It is the manufacture approach of a ceramic honeycomb structure object of adhering, drying and calcinating after that the slurry for septum strengthening which made the dispersion medium distributing the charge of septum reinforcement. As a dispersion medium of this slurry for septum strengthening The manufacture approach of the ceramic honeycomb structure object characterized by using the dispersion medium which uses a water-soluble undissolved liquefied compound as a principal component substantially to this water-soluble organic binder.

[Claim 2] The manufacture approach of a ceramic honeycomb structure object according to claim 1 that the dispersion medium of said slurry for septum strengthening uses at least one sort of the water-soluble alcohol of C1-C5, or the water-soluble ketone of C1-C5 as a principal component.

[Claim 3] The manufacture approach of a ceramic honeycomb structure object according to claim 2 that the dispersion medium of said slurry for septum strengthening contains said water-soluble alcohol or said water-soluble ketone more than 50 mass %.

[Claim 4] The manufacture approach of a ceramic honeycomb structure object given in any 1 term of claims 1-3 in which the dispersion medium of said slurry for septum strengthening contains water below by 50 mass %.

[Claim 5] The manufacture approach of a ceramic honeycomb structure object given in any 1 term of claims 1-4 in which said slurry for septum strengthening contains further the hydroxypropyl methylcellulose, methyl cellulose, hydroxyethyl cellulose, carboxyl methyl cellulose, polyvinyl alcohol, and at least one sort of polymers chosen from the group which consists of a polyvinyl acetal.

[Claim 6] The manufacture approach of a ceramic honeycomb structure object given in any 1 term of claims 1-5 in which said slurry for septum strengthening contains further at least one sort chosen from the group which consists of a sorbitol, a mannitol, hinokitiol, a polyethylene glycol, ethylene glycol, and a glycerol.

[Claim 7] The manufacture approach of a ceramic honeycomb structure object given in any 1 term of claims 1-6 to which adhesion to said septum of said slurry for septum strengthening is performed considering this septum and this slurry for septum strengthening as 5-60 degrees C.

[Claim 8] The manufacture approach of a ceramic honeycomb structure object given in any 1 term of claims 1-7 which remove this slurry that turned down the end face which adhered this slurry for septum strengthening, sprayed the compressed air from the end face opposite to this end face, and adhered superfluously immediately after performing adhesion to said septum of said slurry for septum strengthening.

[Claim 9] The manufacture approach of a ceramic honeycomb structure object given in any 1 term of claims 1-8 which fix said charge of reinforcement to this septum by 10-180-degree C ventilation desiccation after performing adhesion to said septum of said slurry for septum strengthening, or after removing this slurry that adhered still more superfluously.

[Claim 10] The slurry for septum strengthening characterized by containing the charge of reinforcement which is a slurry for septum strengthening for making it adhere to the septum of a honeycomb structure object, and forming the strengthening section in the septum of this honeycomb structure object, and forms this strengthening section, and the dispersion medium which uses a water-soluble undissolved liquefied compound as a principal component substantially to a water-soluble organic binder.

[Claim 11] The slurry for septum strengthening according to claim 10 to which said dispersion medium uses at least one sort of the water-soluble alcohol of C1-C5, or the water-soluble ketone of C1-C5 as a principal component.

[Claim 12] Furthermore, the hydroxypropyl methylcellulose, methyl cellulose, hydroxyethyl cellulose, carboxyl methyl cellulose, polyvinyl alcohol, and the slurry for septum strengthening containing at least one sort chosen from the group which consists of a polyvinyl acetal according to claim 10 or 11.

[Claim 13] Furthermore, a sorbitol, a mannitol, hinokitiol, a polyethylene glycol, ethylene glycol, and the slurry for septum strengthening given in any 1 term of claims 10-12 containing at least one sort chosen from the group which consists of a glycerol.

[Claim 14] In a part of cell depth direction from the end face in which is equipped with two or more septa which form two or more adjoining cells, and this cell carries out [ these two or more septa ] opening It is the ceramic honeycomb structure object which has the strengthening section with small porosity compared with other septum parts. The ceramic honeycomb structure object characterized by the porosity of this strengthening section having been the smallest at the edge by the side of this end face, and having become large continuously in the cell depth direction from the end-face side, and having shifted to these other septum parts automatically.

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DETAILED DESCRIPTION

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## [Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the manufacture approach of the ceramic honeycomb structure object which strengthened \*\*\*\* of the septum in a cel opening end face etc. It is related with the manufacture approach of a ceramic honeycomb structure object that the honeycomb structure object which is baking and strengthened \*\*\*\* of the septum in a cel opening end face once is acquired etc., in more detail by making the slurry which it is [ slurry ] the phase of the desiccation object before baking, and made the charge of reinforcement contain adhere to \*\*\*\* of the septum concerned.

[0002]

[Description of the Prior Art] If it is in the ceramic honeycomb structure object widely used for the catalyst support for emission gas purification etc., that it should correspond to the emission control tightened up every year, the higher purification engine performance is called for, it is one of these and reduction of pressure loss is also called for from the request of low fuel consumption, a high increase in power, etc.

[0003] Under such a situation, raising the numerical aperture in the cel opening end face of a honeycomb structure object, and reducing pressure loss by making thickness of the septum of a honeycomb structure object much more thin, the heat capacity of a septum was reduction-ized, the catalyst was activated at an early stage after engine starting, and the motion which raises the purification engine performance has become strong.

[0004] On the other hand, with progress of the formation of a thin wall of such a honeycomb structure object, the various foreign matters mixed into exhaust gas collide with the septum of a honeycomb structure object, and the erosion phenomenon in which a septum is shaved off poses a new problem.

[0005] But also to this problem, the honeycomb structure object which prepared the strengthening section which raised reinforcement is already proposed rather than other septum sections at the edge in the cel opening end face of a septum, and many things are examined also about the methods (JP,2000-51710,A official report etc.) of preparing the strengthening section.

[0006] The slurry which it is [ slurry ] an edge in a cel opening end face, and made the dispersion medium distribute a cordierite-ized raw material to the septum of the base material concerned after calcinating conventionally the base material of the honeycomb structure which uses a cordierite-ized raw material as a principal component as an approach of preparing the strengthening section is made to adhere, and the approach of drying and calcinating is learned after that (this number official report etc.).

[0007] However, this approach was what the baking process which requires a very large-scale facility and long time amount is needed in two steps called baking of a base material and baking for preparing the strengthening section, and leaves a big technical problem in respect of productive efficiency, product cost, etc.

[0008] On the other hand, the method of performing baking of a base material and formation of the strengthening section is indicated by one baking by making the slurry for septum strengthening which made the dispersion medium distribute the charge of septum reinforcement adhere, and drying and calcinating after that in the phase before calcinating the base material of honeycomb structure, at the edge in the cel opening end face of the septum which the base material concerned has, (this number official report).

[0009] However, the present condition is that a concrete examination now is not made at all about this approach about a difference of the ingredient presentation in the base material before baking and the base material after baking (this number official report). Although the organic binder added for the purpose of usually improving the reinforcement of a septum in the base material before baking existed especially, many of these organic binders were not taken into consideration at all about the point which are water-soluble compounds, such as methyl cellulose.

[0010] For this reason, the honeycomb structure object acquired had deformation to the septum, and, as for AISO static reinforcement etc., it was inadequate practically to have performed the strengthening section formation process which was performing the charge of septum reinforcement after the conventional baking using the slurry distributed in water as it was.

[0011] Although the problem which deformation etc. generates to a septum was solved on the other hand when the slurry which made the nonaqueous solubility dispersion medium distribute the charge of septum reinforcement was used, since the dispersibility of the charge of septum reinforcement was inadequate, it had the problem that the septum thickness of the strengthening section formed, the consistency of reinforcement, etc. tend to become uneven, and the stable erosion-proof nature was not obtained.

[0012] Moreover, with the honeycomb structure object which prepared the conventional strengthening section, what porosity was made [ what ] small and raised erosion-proof nature is indicated (this number official report). However, although there is a coefficient-of-thermal-expansion difference based on a difference of porosity, since porosity was changing rapidly on these boundaries, at the time of baking between each part of the septum concerned, and use, thermal stress tended to increase in this boundary part, and this honeycomb structure object was not necessarily enough as thermal shock resistance in the strengthening section and the other septum section.

[0013]

[Problem(s) to be Solved by the Invention] It is in offering the manufacture approach of a honeycomb structure object that the erosion-proof nature which the honeycomb structure object which the improvement in productivity and low cost-ization of a product can be improved sharply, and there is moreover no deformation etc. in a septum, and has the desired engine performance is acquired, and the first purpose has the still more uniform strengthening section, and was stabilized can be demonstrated, by making this invention in view of the

trouble of the above conventional techniques.

[0014] Moreover, the second purpose of this invention is to be the boundary of the strengthening section which raised erosion-proof nature, and the other septum sections, and for there be no generating of thermal stress, and offer a honeycomb structure object with very big thermal shock resistance by eburation.

[0015]

[Means for Solving the Problem] this invention person came to complete the header and the manufacture approach of this invention for an above-mentioned trouble being solvable by using the dispersion medium which uses a water-soluble undissolved liquefied compound as a principal component substantially to a water-soluble organic binder as a dispersion medium of the slurry for septum strengthening, as a result of inquiring wholeheartedly in view of an above-mentioned trouble. Moreover, this invention person came to complete the honeycomb structure object of this invention by changing porosity continuously about the strengthening section of the honeycomb structure object acquired.

[0016] Namely, according to this invention, use a ceramic ingredient as a principal component and the plastic matter containing a water-soluble organic binder is fabricated. Produce the base material of the honeycomb structure in which two or more cells are formed by two or more septa, and at the edge in a cell opening end face to two or more septa of a base material. It is the manufacture approach of a ceramic honeycomb structure object of adhering, drying and calcinating after that the slurry for septum strengthening which made the dispersion medium distributing the charge of septum reinforcement. As a dispersion medium of the slurry for septum strengthening. The manufacture approach of the ceramic honeycomb structure object characterized by using the dispersion medium which uses a water-soluble undissolved liquefied compound as a principal component substantially to a water-soluble organic binder is offered.

[0017] In this invention, it is desirable that the dispersion medium of the slurry for septum strengthening uses at least one sort of the water-soluble alcohol of C1-C5 or the water-soluble ketone of C1-C5 as a principal component. Under the present circumstances, as for the water-soluble alcohol concerned or the water-soluble ketone concerned, it is desirable to make it contain more than 50 mass % in a dispersion medium. Moreover, as long as it is below 50 mass %, water may be made to contain in a dispersion medium.

[0018] Moreover, in this invention, it is desirable to contain at least one sort chosen from the group which becomes a slurry for septum strengthening from the hydroxypropyl methylcellulose, methyl cellulose, hydroxyethyl cellulose, carboxyl methyl cellulose, polyvinyl alcohol, and a polyvinyl acetal further, and polyvinyl alcohol or a polyvinyl acetal is desirable especially.

[0019] In this invention, it is desirable to make the slurry for septum strengthening contain at least one sort of a sorbitol, a mannitol, hinokitiol, a polyethylene glycol, ethylene glycol, or a glycerol further from the point of rapid volatilization prevention of a dispersion medium.

[0020] Moreover, it is desirable to perform a septum and the slurry for septum strengthening as 5-60 degrees C, and after the adhesion concerned or after adhesion to the septum of the slurry for septum strengthening removes the slurry which adhered still more superfluously, it is desirable [ adhesion ] to fix the charge of reinforcement to a septum by 10-180-degree C ventilation desiccation.

[0021] According to this invention, further, it is made to adhere to the septum of the ceramic structure, and it is a slurry for septum strengthening for forming the strengthening section in the septum of the ceramic structure, and the slurry for septum strengthening characterized by containing the charge of reinforcement which forms the strengthening section, and the dispersion medium which uses a water-soluble undissolved liquefied compound as a principal component substantially to a water-soluble organic binder is offered.

[0022] In this invention, it is desirable that a dispersion medium uses at least one sort of the water-soluble alcohol of C1-C5 or the water-soluble ketone of C1-C5 as a principal component. Moreover, in this invention, it is desirable that the slurry for septum strengthening concerned contains at least one sort chosen from the group which consists of the hydroxypropyl methylcellulose, methyl cellulose, hydroxyethyl cellulose, carboxyl methyl cellulose, polyvinyl alcohol, and a polyvinyl acetal further.

[0023] Moreover, it is desirable that the slurry for septum strengthening contains at least one sort of a sorbitol, a mannitol, hinokitiol, a polyethylene glycol, ethylene glycol, or a glycerol further from the point of rapid volatilization prevention of a dispersion medium.

[0024] In addition, as a water-soluble organic binder used by this invention, the hydroxypropyl methylcellulose, methyl cellulose, hydroxyethyl cellulose, carboxyl methyl cellulose, polyvinyl alcohol, or a polyvinyl acetal can be mentioned.

[0025] According to this invention, in moreover, a part of cell depth direction from the end face in which is equipped with two or more septa which form two or more adjoining cells, and a cell carries out [ two or more septa ] opening. It is the honeycomb structure object which has the strengthening section with small porosity compared with other septum parts. The porosity of the strengthening section concerned is the smallest at the edge by the side of an end face, and becomes large continuously in the cell depth direction from an end-face side, and the honeycomb structure object characterized by having shifted to other septum parts automatically is offered. In addition, "nature" is saying "without being accompanied" by the abrupt change of porosity semantics.

[0026]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained concretely, referring to a drawing. Drawing 1 is process drawing showing typically the operation gestalt of 1 in the manufacture approach of this invention.

[0027] As shown in drawing 1, the first manufacture approach of this invention A ceramic ingredient is used as a principal component, the plastic matter 1 containing a water-soluble organic binder is fabricated, and the base material 2 of the honeycomb structure in which two or more cells 4 are formed by two or more septa 3 is produced. Subsequently At the edge in the cell opening end face 5 to two or more septa 3 of the base material 2 obtained in the phase before baking. The place by which adheres, dries, and calcinates after that the slurry 7 for septum strengthening which made the dispersion medium distribute the charge of septum reinforcement, and it is characterized [ the ] It is in the place which uses the dispersion medium which uses a water-soluble undissolved liquefied compound as a principal component substantially to a water-soluble organic binder as a dispersion medium of the slurry 7 for septum strengthening.

[0028] According to the manufacture approach of this invention, by one baking, can perform baking of a base material 2 and formation of the strengthening section 12 to coincidence, of course, can improve the improvement in productivity, and low cost-ization of a product sharply, but In order to use an undissolved dispersion medium substantially to a water-soluble organic binder, the honeycomb structure object 10 which has the engine performance of the request which a water-soluble organic binder hardly dissolves the slurry 7 for septum strengthening when it adheres to a septum 3, and does not have septum deformation, such as cell \*\*\*\*, is acquired. In addition, by the manufacture approach of this invention, in order to use the dispersion medium which uses a water-soluble compound as a principal component, the dispersibility of the charge 9 of reinforcement in a slurry 7 can improve, the uniform strengthening section 12 can be formed, and the honeycomb structure object 10 which has the stable erosion-proof nature is acquired. Hereafter, it explains concretely for every process.

[0029] In the manufacture approach of this invention, first, a ceramic ingredient is used as a principal component, the plastic matter 1 containing a water-soluble organic binder is fabricated, and the base material of the honeycomb structure in which two or more cells 4 are formed by two or more septa 3 is produced.

[0030] At least one sort chosen from a silicon, titanium, zirconium, silicon carbide, boron carbide, titanium carbide, zirconium carbide, silicon nitride, boron nitride, aluminum nitride, alumina, zirconia, mullite, and cordierite-ized raw material, aluminum titanate, and the group that consists of sialon as a ceramic ingredient which is the principal component of a plastic matter 1, for example can be mentioned.

[0031] moreover — as a water-soluble organic binder — the hydroxypropyl methylcellulose, methyl cellulose, hydroxyethyl cellulose, carboxyl methyl cellulose, polyvinyl alcohol, or a polyvinyl acetal — it can mention — the purpose — responding — one sort — or what is necessary is just to make two or more sorts contain

[0032] A plastic matter 1 may be made to contain other additives if needed, for example, a crystal growth assistant, a dispersant, or an ostomy agent may be made to contain in the manufacture approach of this invention. Moreover, as a crystal growth assistant, a magnesia, a silica, yttria, or ferrous oxide can be mentioned, and ethylene glycol, a dextrin, fatty-acid soap, or polyalcohol can be mentioned as a dispersant, for example. Moreover, as an ostomy agent, graphite, wheat flour, starch, phenol resin, or polyethylene terephthalate can be mentioned, for example.

[0033] As the production approach of a plastic matter 1, that what is necessary is just to carry out by the usual approach, after carrying out specified quantity mixing of the dispersion media, such as water, and adding other additives to the raw material which added additives, such as a water-soluble organic binder, into the ceramic ingredient if needed, it can knead and obtain with a vacuum kneading machine etc.

[0034] In this invention, although there is especially no limit also about the approach of fabricating a plastic matter 1, it is the point of excelling in mass-production nature, and extrusion molding is desirable, for example, it is desirable to carry out extrusion molding using the extrusion-molding equipments 11, such as ram type extrusion-molding equipment and biaxial screw-type continuous-extrusion-molding equipment.

[0035] Moreover, the desired honeycomb structure object 10 can be acquired in this invention, without there being especially no limit about the septum thickness of a base material 2, for example, making a septum produce deformation also as a base material 2 with a minimum septum thickness of 0.100mm or less.

[0036] It is a phase before baking, and it is an edge in the cell opening end face 5, and the slurry 7 for septum strengthening which made the dispersion medium distribute the charge of septum reinforcement is adhered [ in / next / this invention ] to two or more septa 3 of the obtained base material 2.

[0037] The thing from which the same ingredient as the charge of a principal member which constitutes the base material 2 used by this invention of which \*\* above-mentioned was done that what is necessary is just what currently can form the big strengthening section 12 of erosion-proof nature after baking as a charge of septum reinforcement used by this invention or the ingredient which constitutes the \*\* base material 2, and a presentation ratio differ, or the ingredient into which the melting point of the ingredient which constitutes a base material 2 is reduced can be mentioned.

[0038] \*\* At the charge of reinforcement, a thermal-expansion range with other septum sections is small, and the strengthening section 12 obtained can improve erosion-proof nature, without increasing thermal stress. Moreover, as a charge of reinforcement of \*\*, when a cordierite-ized raw material constitutes a base material 2 from an ingredient of a principal component, the cordierite-ized raw material of the same presentation can be mentioned, for example.

[0039] On the other hand, erosion-proof nature can be improved at the charge of septum reinforcement of \*\*, without the eburation by melting happening by some septa at the time of baking, and increasing septum thickness in the septum part which adhered the slurry 7 for septum strengthening containing the charge of septum reinforcement concerned, since the melting point of the ingredient which constitutes the septum part concerned falls.

[0040] Moreover, as that from which the ingredient which constitutes a base material 2, and a presentation ratio differ, when a cordierite-ized raw material constitutes a base material from an ingredient of a principal component, it is one sort or two sorts or more of mixture of the talc which is some cordierite-ized raw materials, an alumina, a silica, an aluminum hydroxide, or a kaolin, and what shifting can be mentioned from the stoichiometric composition ratio of cordierite, for example. Moreover, at least one sort of impurities chosen from the group which consists of a mica, a quartz, iron, titanium, copper, aluminum, nickel, and silicon, for example as an ingredient into which the melting point of the ingredient which constitutes a base material 2 is reduced can be mentioned.

[0041] In this invention, although there is especially no limit about the concentration of the charge of septum reinforcement, it is homogeneous, and it is desirable to do 2-30 mass % content of the charge of septum reinforcement among the slurry for septum strengthening, and it is precipitate is the point that few slurries can be obtained and more desirable among the slurry for septum strengthening to do 3-15 mass % content of.

[0042] Next, the dispersion medium used by this invention uses a water-soluble undissolved liquefied compound (it may only be hereafter called a "binder undissolved compound") as a principal component substantially to a water-soluble organic binder. In this invention, a dispersion medium with small viscosity is desirable to extent which can distribute the charge of septum reinforcement, for example, what uses at least one sort of the water-soluble alcohol of C1-C5 or the water-soluble ketone of C1-C5 as a principal component is desirable. Moreover, as water-soluble alcohol of C1-C5, a methanol, ethanol, propanol, a butanol, or the polyol corresponding to these can be mentioned, there is no toxicity to the body especially, viscosity is a small point, and ethanol is desirable. Moreover, as a water-soluble ketone of C1-C5, for example, a methyl ketone, an acetone, ethyl methyl ketone, etc. can be mentioned, and an acetone is desirable especially.

[0043] In order to prevent deformation of a septum 3, it is desirable to contain binder undissolved compounds mentioned above, such as water-soluble alcohol and a water-soluble ketone, more than 50 mass [ in a dispersion medium ] %, as for the dispersion medium in this invention, containing more than 75 mass % is more desirable, and especially its thing contained more than 90 mass % is desirable. On the other hand, while reducing an ignition quality and being able to make handling easy, it is desirable to also make water contain in a dispersion medium at the point which can control discharge of CO<sub>2</sub>. However, it is desirable to make content below into 50 mass % preferably [ making a lot of water contain in that deformation of a septum is prevented ]. In addition, it cannot be overemphasized that other dispersion media may be made to contain in the range which does not change the summary of this invention.

[0044] Next, further various additives may be made to contain in the slurry 7 for septum strengthening in this invention according to the class of charge of septum reinforcement, the property of the strengthening section made into the purpose, etc.

[0045] As an additive used by this invention, it is desirable to, make thermoplastics, such as organic celluloses, such as hydroxypropyl

methylcellulose, methyl cellulose, hydroxyethyl cellulose, or carboxyl methyl cellulose, polyvinyl alcohol, or a polyvinyl acetal, contain for example. Its dispersibility of the charge of septum reinforcement in a slurry can improve, and these organic celluloses or thermoplastics can form the uniform strengthening section while it can make a septum fix firmly the reinforcement in the slurry 7 for septum strengthening.

[0046] In this invention, also in these, the effectiveness which fixes reinforcement firmly to a septum is a large point, and polyvinyl alcohol or especially a polyvinyl acetal is desirable. In addition, since the organic celluloses and thermoplastics which were mentioned above are used as a binder, the merit that there is no bad influence to the component in other septa also usually has them.

[0047] In this invention, although there is especially no limit about the content of these organic celluloses and thermoplastics, it is desirable to do all 5 in slurry for septum strengthening -15 mass % content of, and it is more desirable to do 7-12 mass % content of.

[0048] Since adhesion to the septum of reinforcement tends to become inadequate that the content of organic celluloses and thermoplastics is under all 5 mass [ in a slurry ] % for septum strengthening, by blasting of the compressed air for removing the superfluous slurry performed later, and the ventilation at the time of desiccation, it is easy to produce dispersion in adhesion of reinforcement, and a range may be produced about reinforcement in strengthening section every place. On the other hand, if the content of organic celluloses and thermoplastics exceeds all 15 mass [ in a slurry ] %s for septum strengthening, the viscosity of a slurry will increase and it will become easy to produce the blinding of a cel, and local thick-ization of a septum.

[0049] In this invention, it is desirable to make polyols, such as a sorbitol, a mannitol, hinokitol, a polyethylene glycol, ethylene glycol, or a glycerol, contain further in the slurry 7 for septum strengthening. When these polyols were made to contain in the slurry 7 for septum strengthening and the slurry 7 concerned is made to adhere to a septum, rapid volatilization of the dispersion medium which uses water-soluble alcohol, a water-soluble ketone, etc. as a principal component can be controlled, and the so-called cel piece can be prevented.

[0050] Moreover, without reducing the effectiveness by the dispersion medium which uses as a principal component water-soluble liquefied compounds mentioned above, such as water-soluble alcohol and a water-soluble ketone, they are the points that the desired cel piece prevention effectiveness is acquired, as for these polyols, it is desirable to do all 2 in slurry for septum strengthening -50 mass % content of, and it is more desirable [ polyols ] to do 5-30 mass % content of.

[0051] In this invention, it is the point that the dispersibility of the charge of septum reinforcement in a slurry 7 improves, and the uniform strengthening section is obtained, and it is still more desirable to also make surfactants, such as a dextrin or fatty-acid soap, contain. In addition, as for these surfactants, it is desirable to make it contain by 0.5 - 5 mass % in respect of dispersibility, a cost side, and an environmental side.

[0052] Next, in this invention, in case the slurry 7 for septum strengthening is adhered to a septum, it is desirable to perform a septum and the slurry for septum strengthening as temperature of 5 degrees C or more. Since a septum and the slurry for septum strengthening become [ the viscosity of the slurry concerned ] large at less than 5 degrees C, it tends to become difficult to make a slurry adhere by uniform thickness.

[0053] However, when adding the organic celluloses mentioned above and thermoplastics, it is desirable to perform a septum and the slurry for septum strengthening as temperature of 60 degrees C or less. If a septum and the slurry for septum strengthening exceed 60 degrees C, gelation or crystallization of these additives will become easy to take place, and it will become difficult to make a slurry adhere by uniform thickness by the component concerned gelled or crystallized.

[0054] Next, it sets to this invention, a base material 2 is dried and calcinated, and baking of a base material 2 and formation of the strengthening section 12 are performed at 1 time of a baking process.

[0055] In this invention, in case a base material 2 is dried, it is desirable to blow away the slurry 7 for septum strengthening which adhered superfluously beforehand by a compressed air etc. at the point that the time amount of the desiccation which is the following process can be shortened.

[0056] Moreover, in this invention, although there is especially no limit about the desiccation conditions of a base material 2, it is desirable to carry out ventilation desiccation at 10-180 degrees C, and to make a septum 3 fix the charge 9 of reinforcement. At less than 10 degrees C, the drying time is long and is not desirable on productive efficiency. On the other hand, if it exceeds 180 degrees C, like the usual septum section, a usual septum intersection, etc., the drying shrinkage difference between each part of a septum by rapid desiccation will become large, and the adhering slurry will become easy to produce cel deformation etc. from some differences being in the thickness in each part of a septum.

[0057] Moreover, it is desirable to turn down the end face which adhered the slurry 7 for septum strengthening, and to dry in the case of desiccation, and it is more desirable to spray a compressed air from an end face still more opposite to the end face which adhered the slurry 7 for septum strengthening. Thus, the amount of the charge of reinforcement which fixes can be applied to the lower part (end-face side) from the upper part of the septum part which adhered the slurry 7 for septum strengthening, and it can be made to increase automatically by drying. For this reason, if the ingredient which raises erosion-proof nature by the eburation of a septum is used as a charge of reinforcement, the porosity of the strengthening section is the smallest at the edge by the side of an end face, and becomes large continuously in the cel depth direction from an end-face side, and a honeycomb structure object with the very big shock resistance which has shifted to other septum sections automatically can be acquired.

[0058] In addition, the ventilation direction, the pneumatic pressure in the case of ventilation, etc. can adjust the variation per unit length of porosity in the class of the class of additives, such as methyl cellulose, hydroxyethyl cellulose, or a glycerol, and an amount, and charge of reinforcement and an amount, and a list. moreover, that from which porosity changes uniformly linearly in this invention and the thing which does not change uniformly rounded - any are sufficient. But less than 10% of the range of the porosity of a part (part by the side of an end face) with the smallest porosity of the strengthening section and the septum section which does not prepare the strengthening section is desirable at the point which can give shock resistance sufficient about the honeycomb structure object acquired.

[0059] As for the conditions at the time of calcinating, in this invention, it is desirable to choose desired conditions suitably according to the class of the base material 2 to be used and charge of septum reinforcement.

[0060] What is necessary is just to specifically calcinate at 1350-1450 degrees C, when each of base materials 2 and charges of septum reinforcement uses a cordierite-ized ingredient as a principal component. Moreover, what is necessary is just to calcinate at 1325-1425 degrees C, when a base material 2 uses a cordierite-ized ingredient as a principal component and, for example, uses as a principal component what is one sort or two sorts or more of mixture of the talc which is some cordierite-ized raw materials, an alumina, or a kaolin, and shifts the charge of septum reinforcement from the stoichiometric composition ratio of cordierite.

[0061] In this invention, the honeycomb structure object which demonstrates the stable erosion-proof nature according to the above process



can be manufactured according to 1 time of a baking process, without producing deformation etc. to a septum. Moreover, the porosity of the strengthening section is the smallest in the part by the side of an end face, and can also consider as the honeycomb structure object which has shifted to the septum part which became large continuously and did not prepare the strengthening section in the depth direction from the end-face side automatically, then a honeycomb structure object with very bigger still shock resistance.

[0062]

[Example] Hereafter, although an example explains this invention concretely, this invention is not limited at all by these examples. In addition, about the honeycomb structure object acquired in each example and the example of a comparison, it is the following, and AISO static reinforcement was made and evaluated.

[0063] (AISO static reinforcement) First, with the honeycomb filter and the metal plate of the diameter of said, the both ends of a honeycomb filter were covered, and after fixing a metal plate by the honeycomb filter and the rubber tube of the diameter of said, the rubber tape was stuck on the rubber tube concerned and the outskirts of it, and further, it sealed so that water might not enter. Next, water pressure was raised and the damaged water pressure estimated AISO static reinforcement (Mpa) until it sank the honeycomb filter underwater and the honeycomb filter was damaged in this condition.

[0064] (Example 1) What mixed the methyl cellulose 8 mass section, the lauric-acid potash soap 0.5 mass section, the polyether 2 mass section, and the water 28 mass section was supplied to the continuous-extrusion-molding machine to the ceramic raw material 100 mass section which consists of a cordierite-ized raw material, and the base material of honeycomb structure was produced.

[0065] On the other hand, 5 mass sections distribution of the charge of reinforcement which consists of a cordierite-ized raw material was carried out to the ethanol 100 mass section, further, 6 mass sections addition of the 12.5 mass sections and the glycerol was carried out for the polyvinyl acetal, and the slurry for septum strengthening was prepared.

[0066] Next, in the 20-degree C room temperature ambient atmosphere, the slurry for septum strengthening was made to adhere to the septum of the obtained base material by dipping at the 5mm edge from a cel opening end face at shaft orientations, it was ventilated from the cel opening end face opposite to the end face to which the compressed air of a room temperature was made to adhere immediately after that, and the slurry which adhered superfluously was eliminated.

[0067] Next, after seasoning naturally the base material to which the slurry for septum strengthening was made to adhere for 3 minutes in the 20-degree C room temperature ambient atmosphere and removing a dispersion medium, it heated for 5 minutes at 120 degrees C, and the charge of reinforcement was completely fixed to the septum. Finally, it calcinated at 1430 degrees C for 4 hours, and the honeycomb structure object of the shape of a cylinder of 86% of numerical apertures which has a square cel by the consistency of 62 cels / cm<sup>2</sup> with 90 micrometers in septum thickness, the diameter of 100mm, and height of 100mm was manufactured.

[0068] As the acquired honeycomb structure object was shown in drawing 2, there was no deformation of a septum and the problem did not have AISO static reinforcement practically with 20kg/cm<sup>2</sup> or more, either. Manufacture conditions and the condition of a septum are collectively shown in Table 1.

[0069] (Example 2) The honeycomb structure object was manufactured like the example 1 except having used the slurry which does not make a glycerol contain as a slurry for septum strengthening.

[0070] The acquired honeycomb structure object did not have deformation of a septum like what is shown in drawing 2, and abbreviation, and the problem did not have AISO static reinforcement practically with 20kg/cm<sup>2</sup>, either. In addition, although there was especially no problem on condition that this time, in case the part which does not contain the glycerol, and the base material to which the slurry for septum strengthening was made to adhere are dried, it is thought that performing rapid desiccation at an elevated temperature from the beginning needs to avoid. Manufacture conditions and the condition of a septum are collectively shown in Table 1.

[0071] (Example 3) The honeycomb structure object was manufactured like the example 1 except having used the slurry which does not make a glycerol and a polyvinyl acetal contain as a slurry for septum strengthening.

[0072] The acquired honeycomb structure object was extent which is satisfactory practically, although deformation was accepted in the septum and AISO static reinforcement also became smaller than the honeycomb structure object of 15kg/cm<sup>2</sup> and examples 1 and 2 a little by observation by the magnifier compared with what is shown in drawing 2. Manufacture conditions and the condition of a septum are collectively shown in Table 1.

[0073] (Example 1 of a comparison) The honeycomb structure object was manufactured like the example 1 except having used the slurry which does not make 5 mass partial handbill, a glycerol, and a polyvinyl acetal contain the charge of reinforcement which consists of a cordierite-ized raw material to the water 100 mass section as a slurry for septum strengthening.

[0074] As shown in drawing 3, remarkable deformation of extent which can be clearly checked to a septum with the naked eye was accepted, and the AISO static reinforcement of the acquired honeycomb structure object was also very as small as 5kg/cm<sup>2</sup>, and it was not what can be borne at practical use. Manufacture conditions and the condition of a septum are collectively shown in Table 1.

[0075]

[Table 1]

	隔壁強化用スラリー		隔壁変形	アイソスタティック強度 (kg/cm <sup>2</sup> )
	分散媒	添加物		
実施例 1	エタノール	(P. V. A) + グリセリン	無し	20
実施例 2	エタノール	(P. V. A) +	無し	20
実施例 3	エタノール	無し	一部変形有り	15
比較例 1	水	無し	著しい変形有り	5

\* 1 P. V. A : ポリビニルアセタール

[0076] To the septum of the base material of the point using the silica (SiO<sub>2</sub>) as a charge of septum reinforcement, and honeycomb structure, (Example 4) In a 20-degree C room temperature ambient atmosphere From a cel opening end face, to shaft orientations (the cel depth direction) in the septum part to 10mm Make the slurry for septum strengthening adhere by dipping, and the cel opening end face which adhered the slurry for septum strengthening is turned down immediately after that. It ventilated from the cel opening end face opposite to the end face to which the compressed air of a room temperature was made to adhere, and the honeycomb structure object was manufactured like the example 1 except having eliminated the slurry which adhered superfluously.

[0077] About the acquired honeycomb structure object, change of the porosity in the cel depth direction was measured from the cel opening end face of the strengthening section. In addition, change of porosity divided the septum in the cel depth direction on the basis of the cel opening end face in four (0-5mm, 5-10mm, 10-15mm, and 15-20mm), and evaluated it in quest of porosity about each range. Moreover, porosity was measured by the mercury press fit type porosimeter by the microphone ROMERI tex company, and asked for the true specific gravity of cordierite as 2.52g/cc.

[0078] As shown in drawing 4, porosity had shifted automatically [ the acquired honeycomb structure object ] in the septum section in which porosity did not prepare the strengthening section by becoming large respectively continuously from a cel opening end face to 24.0%, 27.5%, 29.0%, 29.0%, and the cel depth direction in four (0-5mm, 5-10mm, 10-15mm, and 15-20mm). Moreover, the range of the porosity in the range of 0-5mm and the range of 15-20mm was 5.0%. The condition of the change of porosity to Table 2 by manufacture conditions and the condition of a septum is summarized to drawing 4, and is shown.

[0079] To the septum of the base material of the point using talc as a charge of septum reinforcement, and honeycomb structure, (Example 5) In a 20-degree C room temperature ambient atmosphere From a cel opening end face, to shaft orientations (the cel depth direction) in the septum part to 10mm Make the slurry for septum strengthening adhere by dipping, and the cel opening end face which adhered the slurry for septum strengthening is turned down immediately after that. It ventilated from the cel opening end face opposite to the end face to which the compressed air of a room temperature was made to adhere, and the honeycomb structure object was manufactured like the example 1 except having eliminated the slurry which adhered superfluously.

[0080] When change of porosity is measured like an example 4 about the acquired honeycomb structure object, as shown in drawing 4, porosity in four (0-5mm, 5-10mm, 10-15mm, and 15-20mm) It had shifted to the septum section which porosity became large and did not prepare the strengthening section in 22.5%, 27.0%, 29.0%, 29.0%, and the cel depth direction continuously from the cel opening end face, respectively automatically. Moreover, the range of the porosity in the range of 0-5mm and the range of 15-20mm was 6.5%. The condition of the change of porosity to Table 2 by manufacture conditions and the condition of a septum is summarized to drawing 4, and is shown.

[0081]

[Table 2]

	隔壁強化用スラリー			隔壁変形	アイソスタティック強度 (Kg/cm <sup>2</sup> )
	隔壁強化材料	分散媒	添加物		
実施例 4	シリカ	エタノール	(P. V. A) +I +グリセリン	無し	20
実施例 5	タルク	エタノール	(P. V. A) +I +グリセリン	無し	20

\* 1 P. V. A : ポリビニルアセタール

[0082]

[Effect of the Invention] As explained above, according to this invention, the improvement in productivity and low cost-ization of a product can be improved sharply, the honeycomb structure object which there is moreover no deformation etc. in a septum and has the desired engine performance is acquired, and the manufacture approach of a honeycomb structure object that it has the still more uniform strengthening section and the stable erosion-proof nature can be demonstrated can be offered. Moreover, according to this invention, there is little generating of thermal stress in the strengthening section and other septum parts, and a honeycomb structure object with very big shock resistance can be offered.

[Translation done.]



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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is process drawing showing the operation gestalt of 1 in this invention typically.

[Drawing 2] It is the enlargement in which the configuration of the septum of the ceramic honeycomb structure object acquired in the example of 1 in this invention is shown.

[Drawing 3] It is the enlargement in which the configuration of the septum of the ceramic honeycomb structure object acquired with an example in the conventional manufacture approach is shown.

[Drawing 4] It is the graph which shows change of the porosity of the examples 4 and 5 of this invention.

[Description of Notations]

1 [ - A cel, 5 / - A cel opening end face, 7 / - The slurry for septum strengthening 9 / - The charge of septum reinforcement 10 / - A ceramic honeycomb structure object, 11 / - Extrusion-molding equipment, 12 / - Strengthening section. ] - A plastic matter, 2 - A base material, 3 - A septum, 4

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[Translation done.]

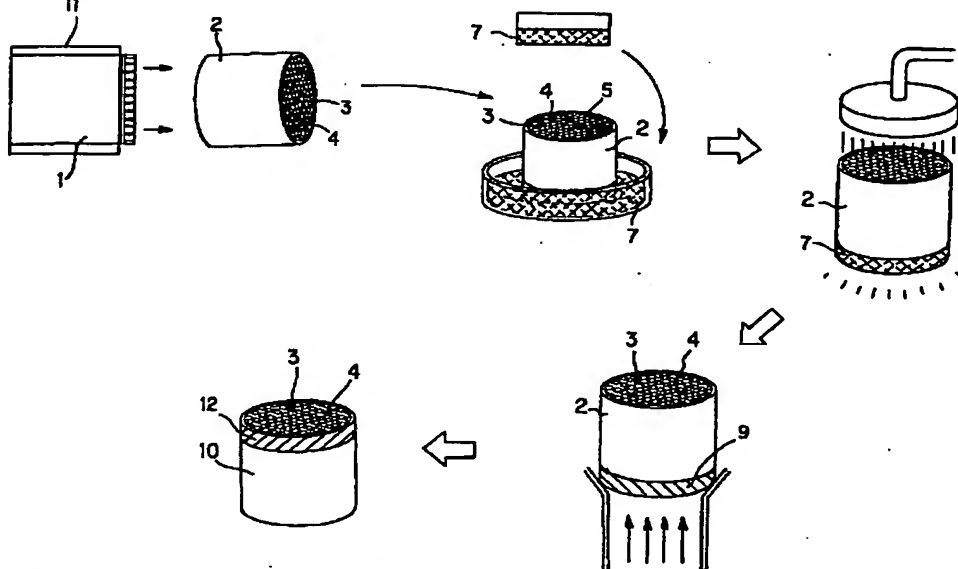
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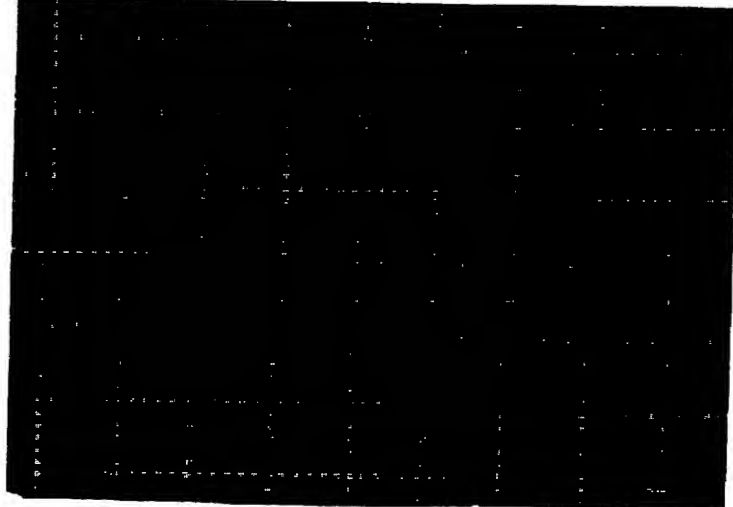
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DRAWINGS

[Drawing 1]

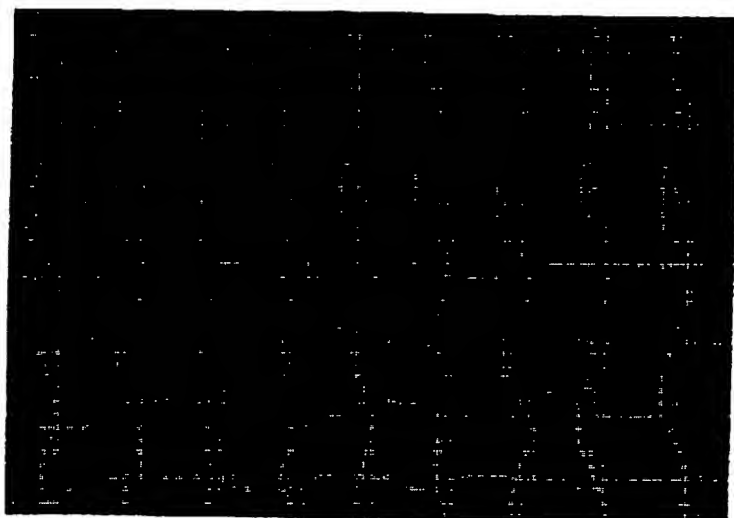


[Drawing 2]

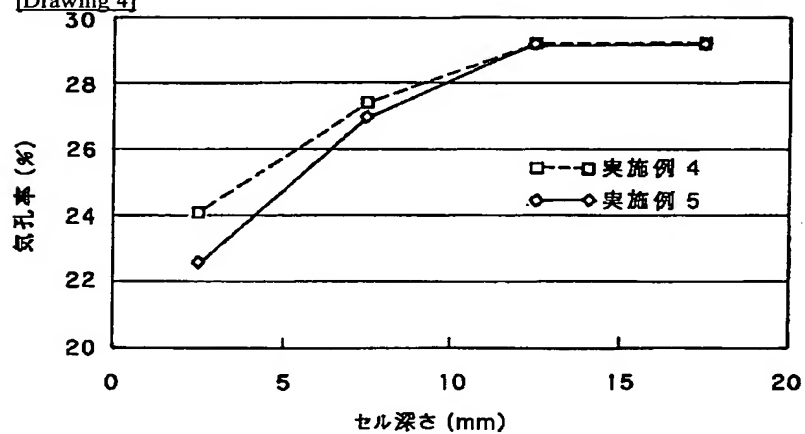


[Drawing 3]

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[Drawing 4]



[Translation done.]

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